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depth is not less than the wave length, λ, whose density is δ, and surface tension T, is $v^2=\frac{g\lambda}{2\pi}+\frac{2\pi T}{\lambda\delta}$.

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Let ϕ denote the velocity. Taking the axis of x in the undisturbed surface and drawing the axis of y vertically downward we get, $C+p/\delta-d\phi/dt$. Since the motion is small, we can neglect the square of the velocity. The equation of continuity is $d^2\phi/dx^2+d^2\phi/dy^2=0$.

$\therefore\ \phi=\Sigma A_n e^{-my}\cos(nt-mx)$. $\therefore\ C+p/\delta=gy+\Sigma nA_n e^{-my}\sin(nt-mx)$.

At the free surface $C\delta+p$ is the excess of the pressure in the liquid over the atmospheric pressure due to the curvature and tension of the surface. Let y_0=the vertical displacement of the free surface, then d^2y_0/dx^2 is the curvature, approximately; hence at the free surface $T/\delta.d^2y_0/dx^2=C+p/\delta=gy_0+\Sigma nA_n\sin(nt-mx)$. Let $y=0$, then $dy_0/dt=d\phi/dy=-\Sigma mA_n\cos(nt-mx)$.

$\therefore\ y_0=-\Sigma(m/n)A_n\sin(nt-mx)$. $\therefore\ d^2y_0/dx^2=\Sigma(m^3/n)A_n\sin(nt-mx)$.

Substituting in the equation at the free surface we must have $m^3T/n\delta=-(m/n)g+n$ or $n^2/m^2=g/m+mT/\delta$. Now $n+2\pi v/\lambda$, $m=2\pi/\lambda$.

$\therefore\ v^2=g\lambda/2\pi+2\pi T/\lambda\delta$.

Also solved by M. E. Graber, A.B., Instructor in Mathematics and Physics, Heidelberg University, Tiffin, O.

AVERAGE AND PROBABILITY.

63. Proposed by COL. CLARKE.*

Three points are taken at random one on each of the three faces of a tetrahedron. What is the chance that a plane passing through them cuts the fourth edge? [From Williamson's *Integral Calculus*, page 410.]

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Let $ABCD$ be the tetrahedron, P a random point in the face ADC, Q a random point in the face ADB. Through A, P draw AF meeting DC in F; through A, Q draw AE meeting BD in E. Let $DB=a$, $DC=b$, $DE=x$, $DF=y$. On DB and DC take G and H on the same side of EF so that $EG=dx$, $FH=dy$.

The chance that a point falls in the triangle AEG is dx/a, that it falls in the triangle AFH is dy/b. In order that the plane through P, Q may cut AC and AB or the face ABC, the third point must fall on the triangle DEF. The chance of this is $(x/a)(y/b)=xy/ab$.

$\therefore$ The whole chance of the plane through P, Q cutting AB and AC is

$$p=\int_0^a\int_0^b\frac{xy}{ab}dxdy/\int_0^a\int_0^b dxdy=\frac{1}{a^2b^2}\int_0^a\int_0^b xydxdy=\tfrac{1}{4}.$$

Similarly the chance of AC and BC being cut is $\frac{1}{4}$, and the chance of AB and BC being cut is $\frac{1}{4}$. $\therefore$ The chance of ABC being cut$=\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=\frac{3}{4}$.

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*Vol. V, 1898, p. 120.